CLAIMS

1. A phase shift mask for an exposure light used to transfer a desired pattern to a light exposed material by a reflection of the exposure light, characterized by comprising:

a reflective mask blank with multilayered films that reflects the exposure light; and

a first and a second regions formed on the reflective mask blank with multilayered films,

wherein each film thickness and each complex refractive index in a formative film of the first region and a formative film of the second region are set to form a prescribed phase difference by a reflected light contained in the exposure light in the first region and a reflected light contained in the exposure light in the second region.

2. The phase shift mask for an exposure light as cited in claim 1, characterized in that;

said exposure light is one of an extreme ultraviolet radiation, X-rays, radioactive rays, ultraviolet rays, and a visible light.

3. The phase shift mask for an exposure light as cited in claim 1, characterized in that;

each film thickness and each complex refractive index in a formative film of the first region and a formative film of the second region are set so that, in addition to the prescribed phase difference, a reflection rate of the reflected light contained in the exposure light in the first region and a reflection rate of the reflected light contained in the exposure light in the second region become approximately equal.

4. The phase shift mask for an exposure light as cited in claim 1, characterized in that;

each film thickness in the formative film of the first region and the formative film of the second region are configured to be approximately equal.

5. The phase shift mask for an exposure light as cited in claim 1, characterized in that;

one or both of the formative film of the first region and the formative film of the second region comprise a multilayer structure including a plurality of materials.

6. The phase shift mask for an exposure light as cited in claim 3, characterized in that;

each film thickness and each complex refractive index in the formative film of the first region and the formative film of the second region are set using an iso-phase contour line and an iso-reflectance contour line.

7. The phase shift mask for an exposure light as cited in claim 6, characterized in that;

the iso-phase contour line is calculated by fixing an imaginary part of the complex refractive index.

8. The phase shift mask for an exposure light as cited in claim 1, characterized in that;

the phase shift mask is one of a halftone phase shift mask and a Levenson phase shift mask.

9. A fabrication method of a phase shift mask for an exposure light having a reflective mask blank with multilayered films

that reflects an exposure light, and a first and a second regions formed on the reflective mask blank with multilayered films, characterized by:

specifying, with reference to an arbitrary complex refractive index to the exposure light and an arbitrary film thickness of each film formed on the reflective mask blank with multilayered films, a phase and a reflectance of a reflected light contained in the exposure light based on the above complex refractive index and the above film thickness; and

selecting, based on the specified phase and the specified reflectance, each film thickness and each complex refractive index in a formative film of the first region and a formative film of the second region, so that the reflected light contained in the exposure light in the first region and the reflected light contained in the exposure light in the second region form a prescribed phase difference.

10. The phase shift mask for an exposure light as cited in claim 9, characterized in that;

said exposure light is one of an extreme ultraviolet radiation, X-rays, radioactive rays, ultraviolet rays, and a visible light.

11. The fabrication method of a phase shift mask for an exposure light as cited in claim 9, characterized in that;

when each film thickness in the formative film of the first region and the formative film of the second region is selected, a phase difference due to a multiple interference in film and a variation of reflection rate relative to the film thickness are considered.

12. The fabrication method of a phase shift mask for an exposure light as cited in claim 9, characterized in that;

the selected complex refractive index and the film thickness are calculated based on a composite complex refractive index performed by a multilayer structure made of a plurality of materials, and a total film thickness.

13. The fabrication method of a phase shift mask for an exposure light as cited in claim 9, characterized in that;

each film thickness and each complex refractive index in the formative film of the first region and the formative film of the second region are set using an iso-phase contour line and an iso-reflectance contour line.

14. The fabrication method of a phase shift mask for an exposure light as cited in claim 13, characterized in that;

the iso-phase contour line is calculated by fixing an imaginary part of the complex refractive index.

15. The fabrication method of a phase shift mask for an exposure light as cited in claim 9, characterized in that;

the phase shift mask is one of a halftone phase shift mask and a Levenson phase shift mask.

16. A fabrication method of a semiconductor apparatus including a lithography process of transferring a desired pattern to a light exposed material using an exposure light phase shift mask, characterized by:

specifying, with reference to an arbitrary complex refractive index to the exposure light and an arbitrary film

thickness of each film formed on a reflective mask blank with multilayered films, a phase and a reflectance of a reflected light contained in the exposure light based on the above complex refractive index and the above film thickness;

selecting, based on the specified phase and the specified reflectance, each film thickness and each complex refractive index in a formative film of the first region and a formative film of the second region, so that the reflected light contained in the exposure light in the first region and the reflected light contained in the exposure light in the second region form a prescribed phase difference;

forming the formative film of the first region and the formative film of the second region on the reflective mask blank with multilayered films based on the selected complex refractive index and the selected film thickness to constitute an exposure light phase shift mask having the first region and the second region on the reflective mask blank with multilayered films; and transferring the desired pattern to the light exposed material using the resultant exposure light phase shift mask.

17. The fabrication method of a semiconductor apparatus as cited in claim 16, characterized in that;

said exposure light is one of an extreme ultraviolet radiation, X-rays, radioactive rays, ultraviolet rays, and a visible light.

18. The fabrication method of a semiconductor apparatus as cited in claim 18, characterized in that;

each film thickness and each complex refractive index in the formative film of the first region and the formative

film of the second region are set using an iso-phase contour line and an iso-reflectance contour line.

19. The fabrication method of a semiconductor apparatus as cited in claim 18, characterized in that;

the iso-phase contour line is calculated by fixing an imaginary part of the complex refractive index.

20. The fabrication method of a semiconductor apparatus as cited in claim 16, characterized in that;

the phase shift mask is one of a halftone phase shift mask and a Levenson phase shift mask.